HARD AND SOFT TISSUE CHANGES IN THE REHABILITATION OF THE ANTERIOR MAXILLA WITH TRIANGULAR SHAPE NECK IMPLANTS: A RETROSPECTIVE CLINICAL STUDY WITH A ONE-YEAR FOLLOW UP

F. D'AVENIA[1], M. DEL FABBRO[2,3], L. KARANXHA[2], T. WEINSTEIN[4], S. CORBELLA[2,3], D. FUMAGALLI[2], L. FRANCETTI[2,3] and S. TASCHIERI[2,3]

[1]Department of Medicine and Surgery, University of Parma, Parma, Italy; [2]Department of Biomedical, Surgical and Dental Sciences, University of Milan, Milan, Italy; [3]IRCCS Istituto Ortopedico Galeazzi, Milan, Italy; [4]Private Practice, Milan, Italy

Aim. Aim of this retrospective study was to evaluate the one-year clinical and radiographic outcomes of implants with a triangular shaped neck inserted immediately after tooth extraction in esthetic zones. Materials and Methods. Patients in which immediate postextraction implants were placed and restored in the anterior maxilla, who underwent a Cone Beam Computed Tomograpy (CBCT) at baseline and after 12-16 months were included. The socket was preserved using deproteinized bovine bone to fill the buccal gap, and a resorbable collagen membrane. One-year implant survival and prosthesis success were evaluated. Hard and soft tissue stability was assessed by measuring various parameters on CBCT images. Clinical evaluation was also performed and Pink Esthetic Score (PES) assessed. Data from baseline and one-year follow-up were statistically compared using paired tests and a significance threshold of p=0.05. Results. Twenty patients (13 males, 7 females, mean age 50.42±11.35 years) were included. Each contributed with one implant. No implant was lost. A significant improvement in PES was detected. Excellent hard and soft tissue preservation was observed after one year of function. Conclusion. Immediate placement of implants with a triangular shaped neck after tooth extraction, can be a suitable solution even for areas with a high aesthetic demand, such as the anterior maxilla.

Implant placement is a well-documented procedure, which, when combined with a good case selection and operator's experience, can produce excellent long term outcomes and high predictability for the replacement of a missing tooth or a tooth that needs to be extracted (1, 2). However, when such tooth is situated in the anterior maxilla, achieving a successful outcome becomes particularly challenging, mainly because of the high aesthetic demand of this region. Several factors have been shown to affect the success rate of implant placement, with timing of implant placement, loading protocol as well as implant design being among the most important ones (3, 4).

When deciding to rehabilitate a post-extraction site, the operator can choose between four different protocols regarding the timing of implant insertion after extraction: immediate, early placement with soft tissue healing, early placement with initial bone healing, and late placement, which includes a healing time of at least six months after extraction (5).

Nowadays, for the anterior maxilla, the

Key words: alveolar socket preservation; anterior maxilla; CBCT; dental implants; hard tissue changes; immediate implants; soft tissue changes

Corresponding author:
Prof. Massimo Del Fabbro
Department of Biomedical, Surgical and Dental Sciences,
Università degli Studi di Milano,
IRCCS Istituto Ortopedico Galeazzi,
Via Riccardo Galeazzi 4, 20161 Milano, Italy
Tel.: +39 02 50319950 - Fax: +39 02 50319960
e-mail: massimo.delfabbro@unimi.it

0393-974X (2019)

late implant placement without using a socket preservation technique is almost never an option, not only for aesthetic reasons but also for the unpredictable level of bone change that a prolonged healing time can produce. Immediate implant placement constitutes a treatment of choice in cases showing a good preservation of the socket's walls after the extracion6. Nevertheless, Physiological alterations of facial and palatal bone surfaces at the implants should be taken into consideration, so that this approach may be considered at risk for esthetic reasons (5, 6).

Conventional periapical radiograph does not allow a proper visualization of the socket bony walls as it only provides a bi-dimensional view. In contrast, dental cone beam computed tomography (CBCT) enable clinicians to accurately evaluate the possibility of placing an implant with respect to alveolar bone anatomy. The latter has become widespread among implantologists as it represents an excellent tool for diagnosis and treatment planning. At the same time, it allows patients for lower radiation exposure with respect to conventional CT-scan technique (7).

When it comes to different loading protocols after implant placement, the traditional approach implies a load-free healing time of 3-6 months. However, for aesthetic demand of this specific region, and because already published studies have reported no difference in terms of implant failure and marginal bone changes between immediate and non-immediate loading protocol (8, 9), the immediate loading protocol has gained much popularity among operator's and patient's preferences.

On the other hand, implant design has been confirmed to play an important role in the overall success of implant placement (10). Implants with a rough surface neck and platform-switching design, are shown to have a higher success rate and lower marginal bone loss than implants with a standard design (11, 12). Countless implant types with different micro and macro design have been proposed (13). However, there is little evidence on whether implants' neck shape can play any role in the overall success rate of an implant, as well as in peri-implant bone preservation.

In the present retrospective study, we aimed to address these three components of an implant treatment protocol of a single tooth post-extraction site in anterior maxilla: immediate implant insertion, immediate loading and triangular neck implant design, and report the a one-year follow up of such combination in terms of function as well as aesthetic outcomes.

MATERIALS AND METHODS

This clinical study was based on patients treated at two dental offices in Northern Italy, between October 2015 and December 2017, all patients were treated following the principles embedded in the Helsinki Declaration. Two equally experienced surgeons performed the operations. A total of 111 patients received a total of 158 implants, inserted immediately after tooth extraction at the anterior maxilla. All patients were recalled at one year follow up. For the present study a sample was selected from such pool of patients, based on the following inclusion criteria: patients with at least one post-extraction implant in the anterior maxilla showing socket walls with no more than 4 mm of buccal bone dehiscence; patients with a thorough clinical and three-dimensional radiographic examination at baseline (prior to implant insertion and immediately after implant insertion); capability to sign an informed consent; thirty to 70 years of age; ASA I (American Society of Anesthesiologists classification); patients who had undergone a further three-dimensional CBCT examination for other medical purposes in a period twelve to sixteen months after implant insertion, in which the anterior maxilla region was visible. Applying the above criteria, twenty patients (13 males and seven females, with a mean age of 50.42 ± 11.35 years), were included in this retrospective clinical study. One implant per patient was evaluated. If patients had more than one implant in the anterior maxilla, only one was chosen randomly by coin toss.

Baseline examination

All patients had received a thorough baseline examination prior to implant insertion, which included the evaluation of the following clinical and radiographic parameters.

Clinical parameters: Gingival biotype (GB) measured by means of periodontal probe assessment as described by

De Rouck et al (14), which was shown to be significantly superior to visual measurements and not significantly different to direct measurements (15); width of keratinized mucosa (KM); mid-facial height of the failing tooth crown (FTCH) if present and intact, defined as the distance from incisal to gingival border of the labial aspect of the crown; the corresponding height of the contra lateral tooth crown (CTCH); the Pink Esthetic Score (PES) of the tooth to be extracted, as reported by Furhauser et al (16). Values for KM, FTCH and CTCH were measured with a periodontal probe to the nearest millimeter.

Surgical procedure

The first step of the surgical procedure consisted of a careful tooth extraction with the intention to minimize the mechanical trauma to the surrounding bone. Then, socket was thoroughly debrided and its apical portion was prepared according to the manufacturer's surgical protocol. A triangular-shaped conical connection bone-level implants with platform switching (V3; MIS Implant Technologies Ltd., Bar-Lev Industrial Park, Israel) was immediately placed in the prepared sites. Care was taken to place the implant shoulder approximately 3 to 4 mm below the ideal buccal gingival margin of the future restoration, leaving one of the sides of the triangular collar on the buccal site. The implant buccal bone gap was filled using a deproteinized bovine bone substitute (Bio-Oss®, Geistlich Pharma, Wolhusen, Switzerland) covered with a resorbable membrane (Bio-Gide®, Geistlich Pharma) in all cases.

Immediate loading with provisional abutments and resin crown was delivered for all cases in the subsequent 24 hours, given an insertion torque value greater than 30 Ncm. Definitive restorations in zirconia were delivered after a minimum of 5 months healing time before the first removal (disconnection) of the provisional restoration.

Follow-up examination

The outcome variables evaluated 12 to 16 months after implant placement were:

1. Implant survival: evaluated based on the following criteria: presence of the implant in the patient's mouth, absence of peri-implant radiolucency, no recurrence or persistent peri-implant infection and no complain of pain and of neuropathies or paraesthesia.
2. Prosthesis success: defined by the presence of functional prosthesis in patient's mouth with no mechanical complications.
3. Buccal bone alterations: evaluated with a radiological examination.
4. Buccal soft tissue alterations: evaluated with a radiological examination.

The above parameters were evaluated by the following methods:

Radiographic examination

All CBCTs were taken with the same device (Promax 3D Classic - Planmeca, Helsinki, Finland) before tooth extraction and immediately after implant insertion in order to evaluate bone graft placement. The device had the following specific technical parameters: Field of View of 8 x 8 cm, voxel size of 0.150 mm, an exposure setting

Table I. *Variables for the Pink Esthetic Score evaluation according to Furhauser et al. (16).*

Variables		0	1	2
Mesial papilla	shape vs reference	Absent	Incomplete	Complete
Distal papilla	shape vs reference	Absent	Incomplete	Complete
Level of soft-tissue margin	Level vs reference tooth	Discrepancy > 2mm	Discrepancy 1-2mm	Discrepancy< 1mm
Soft tissue contour	Natural, matching reference tooth	Unnatural	Fairly natural	Natural
Alveolar process	Alveolar process deficiency	Obvious	Slight	None

of 6.3 mA, 90 kV and a scanning time of 12 seconds. In addition, a further CBCT was taken 12 to 16 months after implant insertion for other medical purposes, was used in all cases where the anterior maxilla region was visible. A dedicated software (Romexis, Planmeca) in combination with a high-resolution screen (5120×2880, 500 nits luminance) was used for measurements, which were recorded in the central-alveolar cross-section slice.

Each CBCT volume was re-oriented according to the long axis of the implant, which was used as a reproducible reference for avoiding image distortion. The central-implant cross section slice served for measurements.
The following parameters were measured on the CBCT.
- Bone Height (BH): The vertical height from the implant platform to the most coronal point of the buccal bone.
- Bone Contact (BC): The vertical height from the implant platform to the first bone-to implant contact point.
- Bone Width (BW): The horizontal thickness of the buccal bone measured at 0 (BW0) and 2 mm (BW2) apical to the platform, respectively.
- Mucosal Height (MH): The vertical height from the implant platform to the marginal soft tissue level.
- Mucosal Width (MW): The horizontal thickness of the buccal mucosa measured at 0 (MW0) and 2 mm (MW2) apical to the platform, respectively.

All parameters were measured at the CBCT immediately after implant insertion and at the one taken at the 12-16 months follow-up. Positive and negative values of BH, BC and MH indicate bone levels coronal and apical to the implant platform, respectively. All distance recordings were done with 0.01 mm precision.

PES index

In order to evaluate objectively the esthetic outcome of the implant crowns at each of the scheduled stage, the PES index was scored by a single operator and critically controlled by two examiners (ST, TW) via digital images. The PES index consisted of five parameters (Table 1) with a maximum score of 10, representing optimum esthetic outcome with respect to the peri-implant soft tissue conditions. The minimum value for clinical acceptability was set to 6.

Statistical analysis

Descriptive statistical analysis was performed. Data were synthesized using mean value and standard deviation for the quantitative variables. Changes in marginal bone level and soft tissue parameters, were evaluated using paired Student's T-test. Statistical significance was set at $P<0.05$.

RESULTS

Implant distribution was as follows: central incisors (seven implants), lateral incisors (four implants), canines (two implants), premolars (seven

Table IIa. *Pre-operative intraoral clinical examination.*

GB		KM, mm	FTCH, mm	CTCH, mm	PES, mm
12 Thick	8 Thin	4.25±1.50	9.00±1.79	9.23±2.35	6.75±1.75

GB: *Gingival Biotype;* ***KM:*** *Width of Keratinized Mucosa;* ***FTCH:*** *Failing Tooth Crown Height;* ***CTCH:*** *Contralateral Tooth Crown Height;* ***PES:*** *Pink Esthetic Score.*

Table IIb. *Pre-operative three-dimensional evaluation of hard and soft tissue parameters.*

	BT1, mm	BT3, mm	BT5, mm	GW, mm	GH, mm
Failing Tooth	1.13±0.60	1.26±0.93	1.05±0.93	0.95±0.25	3.80±1.83
Contralateral Tooth	0.99±0.50	0.97±0.50	1.15±1.07	0.95±0.41	3.28±0.93

BT: *Cortical Bone Thickness;* ***GW:*** *Gingival Width;* ***GH:*** *Gingival Height.*

implants).

Patients' clinical and three-dimensional baseline parameters are shown in Table II a, b. Implant survival was 100% as well as prosthesis success at one-year follow-up.

PES index scores are shown in Table III. A statistically significant improvement was registered at the one-year follow-up. Three-dimensional measurements of bone and soft tissue parameters are shown in Table IV a, b. A statistically significant decrease of the vertical height from the implant platform to the first bone to implant contact (BC) was registered at the one-year follow-up.

Two-dimensional measurements of bone parameters for the 6-month and one year follow up are shown in Table V. A statistically significant difference was registered between the 6-month and one-year follow-up for the mesial bone parameter, with the results at one-year follow-up displaying a lower bone height.

A clinical case is shown in Fig. 1, 2 as an example. Fig. 1a, b illustrates the measurements of the hard and soft tissue parameters at baseline and 1-year follow-up, respectively, using CBCT. Fig. 2a, b shows clinical buccal views of the same case, before extraction and at 1-year follow-up, respectively. The probe in Fig. 2a evidences the buccal bone dehiscence.

Table III. *PES score changes in 1-year follow up.*

pre-op, mm	1 year, mm	change, mm	p value
6.75±1.75	8.39±1.20	1.29±1.92	0.0005

Table IVa. *Evaluation of 3D changes of bone parameters at 1-year follow up.*

	post-op, mm	1 Year, mm	Change, mm	P value
BH	2.28±3.82	1.25±0.91	1.09±4.10	0.45
BC	7.29±3.95	0.39±0.98	7.78±3.50	<0.01
BW0	2.27±1.35	1.71±1.11	0.81±1.25	0.06
BW2	2.52±1.30	1.94±0.93	0.62±0.97	0.06

BH: *Bone Height;* ***BC:*** *Bone Contact;* ***BW:*** *Bone Width.*

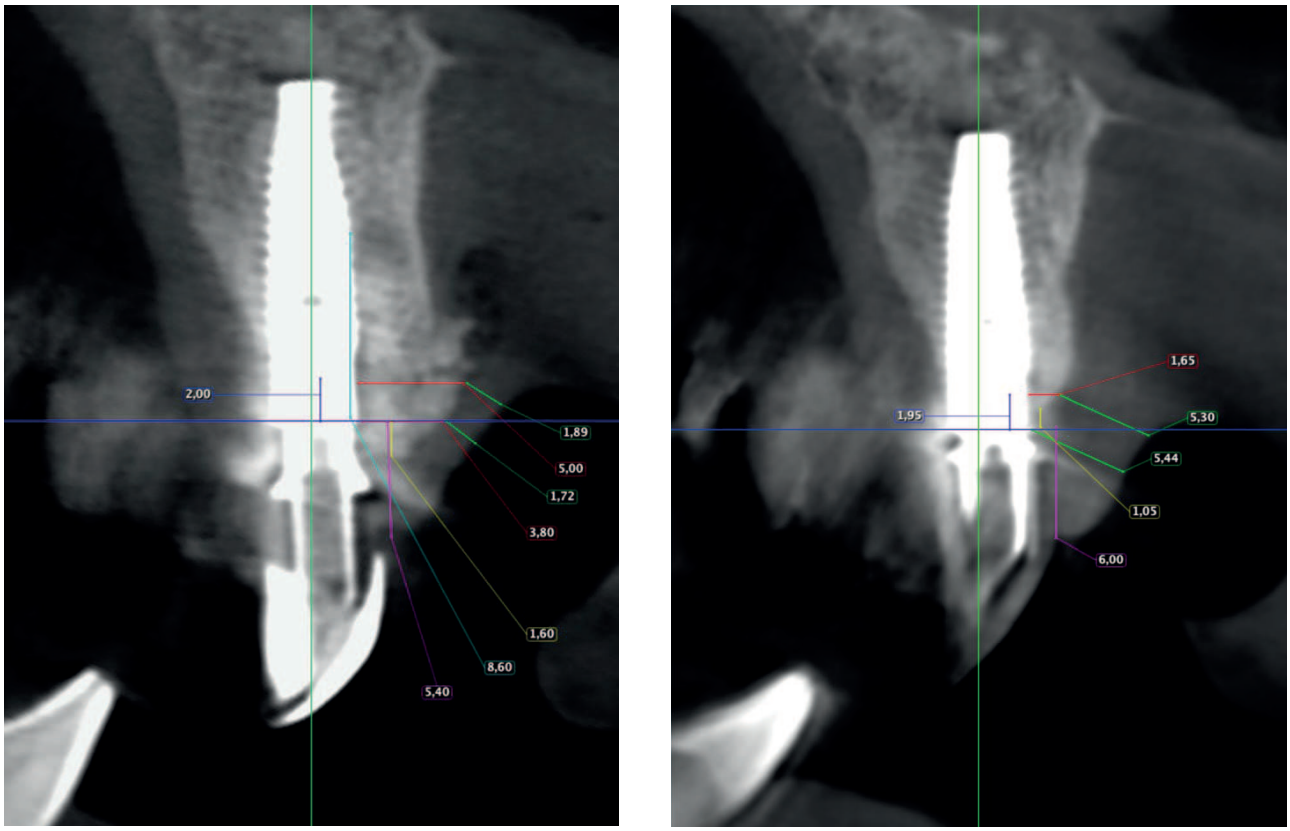
Table IVb. *Evaluation of 3D changes of soft tissue parameters at 1-year follow up.*

	Post-op, mm	1 Year, mm	Change, mm	P value
MH	3.78±1.42	3.83±1.06	0.03±1.12	0.93
MW0	1.84±1.29	1.70±1.27	-0.03±1.79	0.95
MW2	1.75±0.65	1.71±1.23	-0.17±1.40	0.74

MH: *Mucosal Height;* ***MW:*** *Mucosal Width.*

Table V. *Evaluation of 2D changes of bone parameters in 6 months and 1-year follow up.*

	Post-op (A)	6 Months (B)	1 Year (C)	Change (A vs B)	Change (A vs C)	Change (B vs C)
Mesial, mm	0.53±1.64	0.69±1.26	0.59±1.04	-0.19±0.98 (p=0.5)	-0.09±1.14 (p=0.88)	-0.16±0.34 p=0.04
Distal, mm	0.67±2.05	0.52±0.90	0.63±1.18	-0.04±0.79 (p=0.54)	-0.13±1.00 (p=0.71)	0.08±0.74 p=0.59



A B

Fig. 1. *Measurements of the hard and soft tissue parameters at baseline (**a**) and 1-year follow-up (**b**), using CBCT; **BH**=Bone Height (yellow vertical line: 1.60 mm in **a**, 1.05mm in **b**); **BC**=Bone Contact [light blue vertical line: 8.60mm in **a**, 1.05mm (coincident with BC) in **b**]; **BW0**=Bone Width at platform level (red horizontal line: 3.80mm in **a**, not detectable in **b**); **BW2**= Bone Width 2mm apical to platform level (red horizontal line: 5.00mm in **a**, 1.65mm in **b**); **MH**=Mucosal height (purple vertical line: 5.40mm in **a**, 6.00mm in **b**); **MW0**=Mucosal width at platform level (green diagonal line: 1.72mm in **a**, 5.44mm in **b**); **MW2**=Mucosal Width 2mm apical to platform level (green diagonal line: 1.89mm in **a**, 5.30mm in **b**).*

A B

Fig. 2. *Clinical buccal views of the same case, a 49-year old non-smoker male patient. The left upper central incisor was extracted for periodontal reason. (**a**) before extraction: the probe evidences the buccal bone dehiscence of 8mm; (**b**) after 1-year follow-up the soft tissue condition appears healthy. The PES was scored at 7.*

DISCUSSION

The outcomes of implant treatment in the esthetic areas such as anterior maxilla have dramatically improved in the last fifteen to twenty years, parallel to the knowledge of tissue response and the development of specific techniques and materials. The aim of achieving a functional rehabilitation with the best esthetic outcome possible, has encouraged research in three areas: immediate post-extraction implant insertion, immediate loading, and implant design (17). Most of the studies agreed that there is a higher risk of mucosal recession, in the range of 20-30%, related to immediate implant placement when compared to other protocols (18). However, given that well-defined inclusion criteria were not yet established, an ITI Consensus Conference delivered clear clinical guidelines in which strict inclusion criteria were emphasized as one of the main factors influencing the treatment outcome (19).

On the other hand, providing an initial provisional restoration immediately after implant insertion, introduces significant advantages in terms of reducing bone contour changes (20). All patients included in this retrospective study had received a definitive restoration only after five months of provisional loading.

Another aspect that should be considered for the overall success of an implant treatment is implant design. It includes two components: macro-design, referring to implants' body and neck shape, thread design, platform design, diameter and length, and micro-design, referring to its surface properties. Several studies have reported the advantage of the conical body shape and nanoroughness structure of implant surface (21), but very little evidence is available regarding implant neck properties. Implant neck is crucial for achieving primary stability and is also in direct contact with the coronal portion of bone, which is where loading forces are concentrated (22).

In all patients included in this study, a conical implant design with an innovative triangular neck shape was used (V3 implant, MIS). In a recent study on animals, the V3 implant was compared with another implant with the same body and surface characteristics, but with a cylindrical neck shape. The study reported a better peri-implant soft and hard tissues health on the V3 implant, correlating this result to the triangular neck shape of the implant as the only parameter that differed from the other implant involved in the study (23). In another clinical study, which used the same implant design, significantly less bone loss was evidenced in thick

biotype cases when compared to thin or medium biotype. However, two-dimensional radiographs were used in that study, introducing an important limitation in terms of accuracy (24).

In the present study, in addition to the two-dimensional analysis, we added a three-dimensional CBCT evaluation of the bone and soft tissue parameters, as the literature confirms the reliability of CBCT in such analysis (25).

Based on the results of our three-dimensional analysis, no significant difference was registered for Bone Height (BH) and Bone Width (BW) in a one year. A slight vertical and horizontal bone loss in a one year follow-up for an implant treatment protocol is a common clinical finding in everyday practice, but the fact that the difference is not significant when compared to baseline, supports this treatment protocol as suitable even for esthetic areas like the anterior maxilla. On the other hand, a significant reduction was seen for the Bone Contact (BC) parameter. That can be explained with the fact that, the first bone to implant contact point can be situated in a very apical position due to the irregular shape of the post-extraction site. However, after bone regeneration occurs, the alveolar socked is reshaped and the bone to implant contact is relocated more coronally, as can be seen in Fig. 1b.

Regarding soft tissue parameters, no significant difference was registered for Gingival Height (GH) and Gingival Width (GW) in the one year follow up. This result, combined with a significantly improved PES score, indicates a favorable esthetic outcome of this treatment approach. The extent to which implant neck triangular shape affected this outcome is difficult to quantify. The triangular shape of the neck, with one side of the triangular collar facing the cortical bone, is believed to favor bone regeneration by providing more space between implant and cortical bone for the bone graft material to be placed and for the blood flow accumulation.

Lastly, an attempt was made in order to find a correlation between the vertical mucosal height and the level of bone and soft tissue loss. However, all patients included in our study, except one, had a thick mucosal height (>3 mm), and no such correlation could be done.

In the present retrospective study, the combination of immediate implant placement after tooth extraction and a triangular shaped implant neck resulted in good results in terms of bone and soft tissue preservation as well as aesthetics. Consequently, such treatment protocol could be suitable even for areas with a high aesthetic demand, such as anterior maxilla. Further studies are encouraged with a larger sample size, and with a possible correlation between vertical mucosal height and bone and soft tissue loss.

REFERENCES

1. Simonis P, Dufour T, Tenenbaum H. Long-term implant survival and success: A 10-16-year follow-up of non-submerged dental implants. Clin. Oral Implants Res 2010; 772-7..
2. Leonhardt A, Gröndahl K, Bergström C, Lekholm U. Long-term follow-up of osseointegrated titanium implants using clinical, radiographic and microbiological parameters. Clin. Oral Implants Res 2002; 13:127-32.
3. Testori T, Weinstein T, Scutellà F, Wang H L, Zucchelli G. Implant placement in the esthetic area: criteria for positioning single and multiple implants. Periodontol 2000; 77:176-96.
4. Geckili O, et al. Evaluation of possible prognostic factors for the success, survival, and failure of dental implants. Implant Dent 2014; 23:44-50.
5. Hämmerle CHF, Chen ST, Wilson TG. Consensus statements and recommended clinical procedures regarding the placement of implants in extraction sockets. Int J Oral Maxillofac Implants 2004; 19Suppl:26-8.
6. Buser D, Chappuis V, Belser UC, Chen S. Implant placement post extraction in esthetic single tooth sites: when immediate, when early, when late? Periodontol 2000 2017; 73:84-102.
7. Tyndall DA, Price JB, Tetradis S, Ganz C, Hildebolt C. Position statement of the American Academy of Oral and Maxillofacial Radiology on selection criteria for the use of radiology in dental implantology with emphasis on cone beam computed tomography. Oral Surg Oral Med Oral Pathol Oral Radiol 2012; 113:817-26.
8. Zhang S, Wang S, Song Y. Immediate loading for implant restoration compared with early or conventional loading: A meta-analysis. J Cranio-Maxillofacial Surg

2017; 45:793-803.
9. Del Fabbro M, Ceresoli V, Taschieri S, Ceci C, Testori T. Immediate loading of postextraction implants in the esthetic area: Systematic review of the literature. Clin Implant Dent Relat Res 2015; 17:52-70.
10. Ríos-Santos JV. Unravelling the effect of macro and microscopic design of dental implants on osseointegration: a randomised clinical study in minipigs. J Mater Sci Mater Med 2018; 29:99. doi: 10.1007/s10856-018-6101-1
11. Smeets, R. et al. Impact of dental implant surface modifications on osseointegration. Biomed Res Int 2016; doi: 10.1155/2016/6285620.
12. Lazzara RJ, Porter SS. Platform switching: a new concept in implant dentistry for controlling postrestorative crestal bone levels. Int J Periodontics Restorative Dent 2006; 26:9-17.
13. Oshida Y, Tuna EB, Aktoren O, Gençay K. Dental Implant Systems Int J Mol Sci 2010; 11:1580-678.
14. De Rouck T, Eghbali R, Collys K, De Bruyn H, Cosyn J. The gingival biotype revisited: Transparency of the periodontal probe through the gingival margin as a method to discriminate thin from thick gingiva. J Clin Periodontol 2009; 36:428-33.
15. Kan JYK, Morimoto T, Rungcharassaeng K, Roe P, Smith DH. Gingival biotype assessment in the esthetic zone: visual versus direct measurement. Int J Periodontics Restorative Dent 2010; 30:237-43.
16. Fürhauser R. Evaluation of soft tissue around single-tooth implant crowns: The pink esthetic score. Clin Oral Implants Res 2005; 16:639-44.
17. Buser D, Sennerby L, De Bruyn H. Modern implant dentistry based on osseointegration: 50 years of progress, current trends and open questions. Periodontol 2000 2017; 73:7-21.
18. Chen S, Buser D. Esthetic outcomes following immediate and early implant placement in the anterior maxilla—a systematic review. Int J Oral Maxillofac Implants 2014; 29:186-215.
19. Feine J, et al. Group 3 ITI Consensus Report: Patient-reported outcome measures associated with implant dentistry. Clin Oral Implants Res. 2018; 29Suppl16:270-5. doi: 10.1111/clr.13299.
20. Tarnow D. et al. Flapless postextraction socket implant placement in the esthetic zone: part 1. The effect of bone grafting and/or provisional restoration on facial-palatal ridge dimensional change - a retrospective cohort study. Int J Periodontics Restorative Dent 2014; 34:323-31.
21. Wennerberg A, Albrektsson T. On implant surfaces: a review of current knowledge and opinions. Int J Oral Maxillofac Implants 2009; 25:63-74.
22. AbuhusseinH, Pagni G, Rebaudi A, Wang HL. The effect of thread pattern upon implant osseointegration: Review Clin Oral Implants Res 2010; 21:129-36.
23. Pérez-Albacete Martínez, M. et al. Evaluation of a new dental implant cervical design in comparison with a conventional design in an experimental american foxhound model. Materials (Basel) 2018; 11:462.
24. Linkevicius T. et al. Influence of titanium base, lithium disilicate restoration and vertical soft tissue thickness on bone stability around triangular-shaped implants: A prospective clinical trial. Clin Oral Implants Res 29 2018; 716-724.
25. Ritter L. et al. Accuracy of peri-implant bone evaluation using cone beam CT, digital intra-oral radiographs and histology. Dentomaxillofacial Radiol 2014; 43:1-10.